BTEC Assignment Brief

Qualification	Pearson BTEC International Level 3 Diploma in Engineering Pearson BTEC International Level 3 Extended Diploma in Engineering
Unit number and title	**Unit 31: Thermodynamic Principles and Practice**
Learning aim(s)	**C:** Explore the combustion and sustainability of fuels that are used to produce work in mechanical systems
Assignment title	Investigate applications of thermodynamic systems
Assessor	
Issue date	
Hand in deadline	
Vocational Scenario or Context	Your supervisor is pleased with your understanding of theoretical thermodynamics, and how these are related to the systems that you have investigated. He would now like you to conduct some tests and experiments on fuels to investigate combustion, and to then report on the sustainability issues which relate to the combustion of fuels. You will need to demonstrate that you are able to work safely whilst carrying out experiments, and that you are able to use appropriate calculations to support the findings of your experiments.
Task 1	You are to produce a written report that: a) explains how you safely carried out experiments to determine the calorific values of two different types of fuel, b) shows calculations to determine calorific values of fuels and the mass of air required for the complete combustion of each fuel and c) evaluates the results from your experiments and theoretical calculations, with a consideration of the sustainability of each fuel. **To do this.** Your tutor will provide you with two different fuel samples to determine the calorific value of each fuel by experimentation. You will also undertake a mass analysis of each fuel that you test and determine a theoretical calorific value for each fuel. All calculations should be produced to an appropriate degree of accuracy and using appropriate units. The tasks are to: • Conduct experiments safely so that you can determine the calorific values of, and the combustion requirements, including the mass of air required for the complete combustion of each fuel. • You will need to use a calorimeter to determine the net and gross calorific value of **two** types of fuel (from: solid, liquid and gaseous types) For the solid and liquid fuel calorimeter record the following values: mass of fuel, mass of water heated, water equivalent of the calorimeter and temperature versus time data. For the Boys' gas type calorimeter record the following values: gas supply pressure and temperature, atmospheric

	pressure, volume of gas metered, water inlet and exit temperatures, mass of water collected and mass of condensate collected. • Using theoretical calculations also determine calorific values of each fuel that you conducted experiments on. You then need to write a report to support your findings using appropriate drawings, diagrams and annotated photographs. You should also consider the by-products of combustion and the quantity of incombustible fuel that results from your experiments. You should include: • an evaluation of the experimental results and of the combustion process compared to the results from theoretical calculations; making reference to the laws of thermodynamics as appropriate. • a conclusion to include the sustainability of both fuel types, efficiency of the combustion process, the environmental impacts of combustion, the potential for the use of alternative fuels and how these could impact on the environment.
Checklist of evidence required	A report will focus on safe practical activities using calorimeters in the form of observation records, witness statements and annotated photographs and drawings, along notes which discuss the results of experiments and considerations of sustainability.

Criteria covered by this task:	
Unit/Criteria reference	To achieve the criteria you must show that you are able to:
31/C.D3	Evaluate the combustion of two fuel types and the sustainability implications for mechanical systems, using the results from safely and accurately conducted experiments and accurate theoretical calculations.
31/C.M4	Conduct experiments safely and accurately to determine the net and gross calorific values of two fuel types and find the mass of air required for the complete combustion of a fuel type
31/C.M5	Analyse, using the experimental results and theoretical calculations, the combustion process and calorific values, considering the sustainability implications of the results
31/C.P6	Conduct experiments safely to determine the net and gross calorific values of two fuel types and find the mass of air required for the complete combustion of a fuel type
31/C.P7	Explain, using the experimental results and theoretical calculations, the combustion process and calorific values, considering the sustainability implications of the results

Sources of information to support you with this Assignment	**Books** Nag, P.K.; Engineering Thermodynamics, 2008, McGraw-Hill, ISBN 9780070260627 Rayner, J.; Basic Engineering Thermodynamics, 1996, Pearson Education, ISBN 9788131718889 Sivasankar; Engineering Chemistry, 2008, McGraw-Hill, ISBN 9780070669321 **Websites** Resources may be found at qualifications.pearson.com/en/support/published-resources.html#step1

Note to assessor:

Task 1, 2, 3 etc.	Learners are to determine calorific values for two different types of fuel. One type of fuel should be a solid, with the other either a liquid or gas. Examples of: • solid fuels include: wood, coal, anthracite and coke • liquid fuels include: petrol, fuel oil, vegetable/ cooking oil, paraffin • gaseous fuels include: natural gas (methane), LPG. It is suggested that different learners are given different combinations of fuels for their experiments to help prevent collusion between learners.